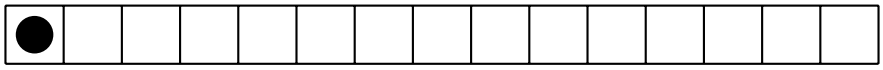
02180: Introduction to Artificial Intelligence
Exercises at week 2

Ex. 1 Consider the following two-player game **Race Game**. Initially there is a token on cell 1. The two players take turn to move the token 1, 2 or 3 cells to the right. The one who moves the token into cell 15 has won.



Play the game a few times in pairs. Reflect on the following questions:

1. What is the best strategy for the first player?
2. How did you come up with it?
3. How can we make AI to play such a game?

Ex. 2 The missionaries and cannibals problem is usually stated as follows. Three missionaries and three cannibals are on one side of a river, along with a boat that can hold one or two people. Find a way to get everyone to the other side without ever leaving a group of missionaries in one place outnumbered by the cannibals in that place. Whenever the boat goes from one side to the other, everybody has to go out before the boat can go back again. The boat can not sail without anybody in it.

1. A *state* is a description of all relevant parameters of a given problem (in this case it should include the positioning of all missionaries and cannibals with respect to the side of the river, and the position of the boat). How can the possible states of the problem be represented? What is then the initial state? Draw a diagram of the complete state space. What is the size of the state space (measured in number of states it contains)?
2. Why do you think people have a hard time solving this puzzle, given that the state space is so simple?
3. Assume instead that there are n missionaries and n cannibals. What is then the size of the state space? You can report the size of the full state space, including the states that are not reachable without violating the constraint of cannibals not outnumbering missionaries. You can measure the size of the state space in number of distinct states. Does the size of the state space imply that the problem is difficult for a computer to solve for big values of n?
4. Assume that in addition to the n missionaries, n cannibals there are now also n boats. Does this imply that the problem is difficult for a computer to solve for big values of n?
5. Assume that in addition to the n missionaries, n cannibals and n boats there are now also n banks instead of only 2. This means that any of the persons and boats can be at any of n banks. Does this imply that the problem is difficult for a computer to solve for big values of n?

Ex. 3 Go to: https://sokoban-game.com/packs/sokogen-990602-levels/ and complete as many levels as possible, starting with Level 1.